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# Slowing Malaria

Audience: Year 7-10, Year 11 Geography and Biology

Time Required: 15 minutes

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**Activity:** This activity investigates causes of disease and ways to control malaria

**Standards:** Some possible links to NZ Curriculum in this inquiry

- Social Studies Level 4 Understand how people participate individually and collectively in response to community challenges.
- Geography AS91013 Describe aspects of a geographic topic at a global scale.
- Biology AS90926 Report on a biological issue

**Learning Outcomes:** Students will

- Students will investigate the spatial patterns of malaria risks.
- Students will analyze environmental factors related to malaria control in Africa.

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**Map URL:** <http://arcg.is/19iDf9>

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## Engage

### Who is at risk for malaria?

- Click the map URL link above to open the map.
- Shaded regions show where over 41 species of mosquitoes can survive and spread malaria.
- ? What countries or regions have environments that will not support the Anopheles mosquito? [*Canada, the lower half of South America, parts of the United States such as Alaska, and some of Russia*]
- Over 3.2 billion people live in areas where these mosquitoes could survive.
- ? With over 7.1 billion people on the earth, what percentage of the world is at risk? [*45%*]

## Explore

### Where is the highest risk for death by malaria?

- ? On the Details pane, click the button, Show Contents of Map.
- ? Clear the checkbox for the layer, Dominant Mosquito Vector Worldwide.
- ? Click the checkbox for the layer, P. falciparum Distribution.
- Plasmodium falciparum is the most deadly parasite that causes malaria.
- ? What environmental factors enable this parasite to survive in this region? [*30oS to 30oN; warm ambient temperatures and adequate rainfall*]
- ? Which region has the highest endemicity (disease intensity)? [*Sub-Saharan Africa*]
- ? Zoom in to Kenya.
- ? Why are some areas malaria-free (gray)? [*Higher altitudes prevent mosquito and plasmodium survival.*]

## Explain

### What progress has been made to reduce malaria in Africa?

- Turn off the map layer, P. falciparum Distribution.
- Click the checkbox to the left of the layer name, Endemic African Countries.
- Zoom out to view Africa. Turn on and off the Endemic African Countries layers for years 2000 & 2015.
- ? What progress was made from 2000 to 2015? Use the legend to better understand the map symbology. *[Malaria incidents have decreased significantly by 40 percent.]*
- ? Brainstorm about the ecology of anopheles mosquitoes. What are some possible controls? *[Pesticides, like DDT; personal sprays, like DEET; and insecticide-treated bed nets (ITNs)]*
- The use of ITNs is the most important factor in children. Click several countries to compare the relationship between use and malaria decrease.

## Elaborate

### What other factors affect malaria?

- ? How will climate change affect endemicity? *[Higher altitudes will be vulnerable; some areas may become too dry for malaria; and an increase extent of anopheles mosquito distribution may occur.]*
- Turn off the Endemic Africa layer and turn on the Sickle Cell layer.
- Pan the countries and brainstorm about why the sickle cell allele persists in certain regions. *[Increased malarial resistance]*

## Evaluate

### Does endemicity affect the control of malaria?

- Turn off the layer, Sickle Cell.
- Turn on and off the layers, Endemic Africa: P. falc.incidence (2000 and 2015).
- Using the search field above the map, search for the country Ghana. (The map will zoom to it.)
- ? Click the country; what is the percent of change in incidence from 2000 to 2015? *[A 42% decrease]*
- Models predict that countries with an endemicity (sustained without external sources of infection) of less than 40% can control malaria with extensive use of ITNs.
- Click several countries to predict whether they will need additional control measures

## Key Skills

### Identify a map feature

- Click any feature on the map, and a pop-up window will open with information.
- Links and images in the window are often clickable.
- An arrow icon in the upper-right of the window indicates that multiple features have been selected. Click the button to scroll through the features

### Use the time slider

- A time-enabled map layer must be visible.
- Click the lower slider button and stretch it to the end time period that you wish to view.
- Click the Play button (right arrow).

## Next Steps

**DID YOU KNOW?** ArcGIS Online is a mapping platform freely available to New Zealand public and private schools. A school subscription provides additional security, privacy, and content features. Learn more about ArcGIS Online and how to get a school subscription at <http://www.eagle.co.nz/gis-schools>

### THEN TRY THIS...

- In an ArcGIS Online organizational subscription for schools, use the Hot Spot Analysis function to identify statistically significant relationships among countries by ITN use and malaria incidence reduction in children aged 2 to 10 years old.
- Explore whether NZ has the climatic conditions that would support the Anopheles mosquito. What impact could a warmer climate have? What biosecurity measures does NZ have in place. Will these need strengthening?

### Text References

- Centres for Disease prevention and control <http://bit.ly/2mJlnF8>

## NEW ZEALAND GEOINQUIRIES

<http://arcg.is/1GPDXe>